# Chapter X

# CHAPTER – X

# APPLICATION OF INTERVAL FUZZY NUMBER MATRICES IN THE ANALYSIS OF THE FACTORS INFLUENCING HIGH SCORES IN HIGHER SECONDARY EXAMINATIONS

## Introduction

High scores in the Higher Secondary Examinations have become the high order priority in the academic life of a student in the present scenario. The parents have more concern and they leave no stone unturned to get their wards a pass with comparatively higher score which enables them to join a course, particularly a professional course, in a reputed institution. Many students perform upto the expectations, though not all.

The author of this thesis intended to analyze the factors contributing high scores in the higher secondary examination and also to identify the prime factor by collecting the data from students, academicians and parents. For the analysis part, the author uses interval valued fuzzy soft sets along with interval fuzzy matrices.

**Definition : 10.1**

Let U be a nonempty finite set of objects called universe and let E be a nonempty set of parameters. An ordered pair (F, E) is said to be a **soft set** over U, where F is a mapping from E into the set of all subsets of U. That is, $F : E \rightarrow P(U)$. It has been interpreted that a soft set indeed is a parameterized family of subsets of U.

**Example : 10.2**

Let $U = \{c_1, c_2, c_3\}$ be the set of three cars and E = {costly ($e_1$), metallic colour ($e_2$), cheap ($e_3$)} be the set of parameters and $A = \{e_1, e_2\} \subset E$. Then $(F, A) = \{F(e_1) = \{c_1, c_2, c_3\}, F(e_2) = \{c_1, c_3\}\}$ is the crisp soft set over U which describes the "attractiveness of the cars" which Mr.X (say) is going to buy.

**Definition : 10.3 [40]**

Let U be a universe. A **fuzzy set** X over U is a set defined by a function $\mu_X$ representing a mapping $\mu_X : U \rightarrow [0, 1]$. Here, $\mu_X$ called membership function of X, and the value $\mu_X(u)$ is called the grade of membership of $u \in U$. The value represents the degree of u belonging to the fuzzy set X. Thus, a fuzzy set X over U can be represented as follows ,

$$X = \{(u / (\mu_X(u)) : u \in U, \mu_X(u) \in [0, 1]\}$$

The set of all the fuzzy sets over U will be denoted by F(U).

**Definition : 10.4**

Let U be a universal set, E a set of parameters and $A \subset E$. Let F(U) denotes the set of all fuzzy subsets of U. Then a pair (F, A) is called **fuzzy soft set** over U, where F is a mapping from A to F(U).

**Example : 10.5**

Let $U = \{c_1, c_2, c_3\}$ be the set of thee cars and E = {costly ($e_1$), metallic colour ($e_2$), getup ($e_3$)} be the set of parameters and $A = \{e_1, e_2) \subset E$. Then (G, A) = {$G(e_1) = \{c_1 / 0.6, c_2 / 0.4, c_3 / 0.3\}$, $G(e_2) = \{c_1 / 0.5, c_2 / 0.7, c_3 / 0.8\}$} is the fuzzy soft set over U describes the "attractiveness of the cars" which Mr.X (say) is going to busy.

**Definition : 10.6 [53]**

An **interval valued fuzzy set** $\hat{X}$ on a universe U is a mapping such that $\hat{X} : U \rightarrow \text{Int}([0, 1])$, where Int ([0, 1]) stands for the set of all closed subintervals of [0, 1], the set of all interval valued fuzzy sets on U is denoted by $\tilde{F}(U)$.

Suppose that $\hat{X} \in \tilde{F}(U)$, $\forall x \in U$, $\mu_{\hat{X}}(x) = [\mu^{-}_{\hat{x}}(x), \mu^{+}_{\hat{x}}(x)]$ is called the degree of membership an element x to $\hat{X}$. $\mu^{-}_{\hat{x}}(x)$ and $\mu^{+}_{\hat{x}}(x)$ are referred to as the lower and upper degrees of membership x to $\hat{X}$ where $0 \le \mu^{-}_{\hat{x}}(x) \le \mu^{+}_{\hat{x}}(x) \le 1$.

**Definition : 10.7 [53]**

Let U be an initial universe and E be a set of parameters, a pair (F, E) is called an **interval valued fuzzy soft set** over $\tilde{F}(U)$ where F is a mapping given by $F : E \rightarrow \tilde{F}(U)$.

**Application of Interval Fuzzy Number Matrices**

To analyze the factors influencing the higher academic performance of higher secondary students, opinion of three groups of respondents were collected. The first group $G_1$ consists of fifty high performers who are pursuing professional courses in leading professional colleges. The second group $G_2$ consists of fifty academicians handling higher secondary subjects. The third group $G_3$ consists of parents of high performers.

The authors conducted a pilot study and identified the following factors influencing high scores in higher secondary examinations.

$F_1$ - Exposure to the scoring techniques

$F_2$ - Better motivation

$F_3$ - Planned preparation

$F_4$ - Proper guidance and counselling

$F_5$ - Special coaching imparted by tuition centers

$F_6$ - Good economic condition and good environment at home

Each respondent was asked to give a score value ranging between 1 and 10 for each factor. Using the data, Mean (M) and Standard Deviation (S.D) were calculated for each group $G_1$, $G_2$, $G_3$. An Interval Fuzzy Number Matrix was framed by taking the six factors $F_1$, $F_2$, $F_3$, $F_4$, $F_5$, $F_6$ as rows and the three groups $G_1$, $G_2$, $G_3$ as columns. Each entry in the matrix is an Interval Fuzzy Number which was framed by taking $\frac{M - S.D}{10}$ and $\frac{M + S.D}{10}$ as the left and right end points of the interval respectively.

$$A = \begin{array}{c} \\ F_1 \\ F_2 \\ F_3 \\ F_4 \\ F_5 \\ F_6 \end{array} \begin{array}{c} \begin{array}{ccc} G_1 & G_2 & G_3 \end{array} \\ \begin{pmatrix} [0.7, 1.0] & [0.9, 1.0] & [0.5, 0.7] \\ [0.6, 0.7] & [0.8, 0.9] & [0.8, 0.9] \\ [0.7, 0.8] & [0.9, 1.0] & [0.6, 0.7] \\ [0.7, 0.8] & [0.8, 0.9] & [0.7, 0.8] \\ [0.7, 0.9] & [0.6, 0.8] & [0.7, 0.8] \\ [0.7, 0.8] & [0.7, 0.8] & [0.8, 0.9] \end{pmatrix} \end{array}$$

The following is the algorithm for finding the solution to the problem using Interval Valued Fuzzy Soft Sets :

**Step 1**

Construct the Interval Valued Fuzzy Soft Set (H, E), where H is a mapping given by $H : E \rightarrow \tilde{F}(U)$. Let $U = \{F_1, F_2, F_3, F_4, F_5, F_6\}$ and $E = \{G_1, G_2, G_3\}$.

$$H(G_1) = \{< F_1, [0.7, 1.0] >, < F_2, [0.6, 0.7] >, < F_3, [0.7, 0.8] >, < F_4, [0.7, 0.8] >, < F_5, [0.7, 0.9] >, < F_6, [0.7, 0.8] >\}$$

$$H(G_2) = \{< F_1, [0.9, 1.0] >, < F_2, [0.8, 0.9] >, < F_3, [0.9, 1.0] >, < F_4, [0.8, 0.9] >, < F_5, [0.6, 0.8] >, < F_6, [0.7, 0.8] >\}$$

$$H(G_3) = \{< F_1, [0.5, 0.7] >, < F_2, [0.8, 0.9] >, < F_3, [0.6, 0.7] >, < F_4, [0.7, 0.8] >, < F_5, [0.7, 0.8] >, < F_6, [0.8, 0.9] >\}$$

**Step 2**

$\forall$ $F_i \in U$, compute the choice value $c_i$ for each features $F_i$ such that $c_i = [c_i^-, c_i^+] = \left[\sum_{G_i \in E} \mu^-_{H(G_i)}(F_i), \sum_{G_i \in E} \mu^+_{H(G_i)}(F_i)\right]$, where i = 1 to 6.

$c_1$ = [2.2, 2.7], $c_2$ = [2.3, 2.6], $c_3$ = [2.2, 2.5], $c_4$ = [2.2, 2.5],

$c_5$ = [2.0, 2.5], $c_6$ = [2.2, 2.5]

**Step 3**

$\forall$ $F_i \in U$, compute the score $r_i$ of $F_i$ such that

$r_i = \sum_{F_j \in U} ((c_i^- - c_j^-) + (c_i^+ - c_j^+))$, where i, j = 1 to 6.

Thus, we have $r_1$ = 1.1, $r_2$ = 1, $r_3$ = – 0.2, $r_4$ = – 0.2, $r_5$ = – 1.4, $r_6$ = – 0.2.

**Step 4**

The decision is any one of the elements in S = $\max_{h_i \in U}\{r_i\}$.

In our problem, the factor **"Exposure to scoring techniques ($F_1$)"** is the best choice because $\max_{h_i \in U}\{r_i\} = \{F_1\}$. This result is reasonable because we can see that $c_1 \geq c_i$, where i = 2, 3, 4, 5, 6. i.e. $F_1$ has the highest choice value.